BIOLOGY, LEGAL STATUS, CONTROL MATERIALS, AND DIRECTIONS FOR USE

Tree Squirrels

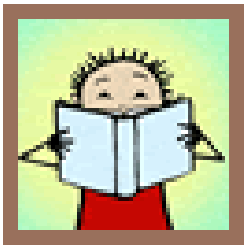
Family: Sciuridae

Fig. 1. Eastern fox squirrel (*Sciurus niger*)

Fig. 2. Eastern gray squirrel (*Sciurus carolinensis*)

Fig. 3. Western gray squirrel (*Sciurus griseus*)

Fig. 4. Douglas squirrel (*Tamiasciurus douglasii*)



Introduction: There are four species of tree squirrels in California, excluding the small nocturnal flying squirrel, which is not considered a pest. Of the four, two species are native and two are introduced from the eastern part of the United States. In their natural habitats they eat a variety of foods including fungi, insects, bird eggs and young birds, pine nuts, and acorns, plus a wide range of other seeds. Squirrels sometimes cause damage around homes and gardens, where they feed on immature and mature almonds, English and black walnuts, oranges, avocados, apples, apricots, and a variety of other plants. During ground foraging, they may feed on strawberries, tomatoes, corn, and other crops. They also have a habit, principally in the fall, of digging holes in garden soil or in turf, where they bury nuts, acorns, or other seeds. This 'caching' of food, which they may or may not ever retrieve, raises havoc in the garden and tears up a well-groomed lawn. They sometimes gnaw on telephone cables and may chew their way into wooden buildings or invade attics through gaps or broken vent screens. Tree squirrels carry certain diseases such as tularemia and ringworm that are transmissible to people. They are frequently infested with fleas, mites, and other ectoparasites.

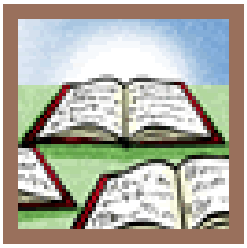
Identification: Tree squirrels are active during the day and are frequently seen in trees, running on utility lines, and foraging on the ground. Tree squirrels are easily distinguished from ground squirrels and chipmunks by their long bushy tails and lack of fleck-like spots or stripes, and the fact that they escape by climbing trees and other structures. All are chiefly arboreal, although the fox and western gray squirrels spend considerable time foraging on the ground.

Of the four tree squirrel species, the eastern fox squirrel (*Sciurus niger* , Fig. 1), sometimes called the red fox squirrel, is by far the most serious pest to homes and gardens in urban and suburban situations, and is an agricultural pest in some areas. This squirrel can be differentiated from the others by its brownish red-orange fur. Fox squirrels were introduced from the eastern part of the United States and are well established in most major cities of California. In some cities, eastern fox squirrels have moved outward into agricultural land, especially in the southern part of the state.

Eastern gray squirrels (*S. carolinensis*, Fig. 2) were originally introduced from the eastern United States into Golden Gate Park in San Francisco, California. They are also established in areas of Calaveras and San Joaquin counties in California and may be expanding their range.

Native western gray squirrels (*S. griseus*, Fig. 3) are found throughout much of California, primarily in oak woodlands of the foothills and valleys and in pine/oak forests, where they feed on a variety of seeds, fungi, and other plant materials. They also have a tendency to strip bark in order to access and feed on the cambium layer, causing injury to trees.

Native Douglas squirrels (*Tamiasciurus douglasii*, Fig. 4), sometimes called chickarees, are found in mostly conifer-forested regions of the north coastal area and along the Sierra Nevada Mountain region. Because of the habitat in which they thrive, the two native tree squirrels are not usually pests, except for the damage they can do in forest regeneration projects. They may, however, become garden or home pests in some of the more remote rural areas.



Legal Status: Tree squirrels are classified as game mammals by the Fish and Game Code and can be taken only as provided by the hunting regulations. However, two exceptions exist. First, eastern fox squirrels (defined as red fox squirrels in the Department of Fish and Game code) found to be injuring growing crops or other property may be taken at any time or in any manner by the owner or tenant of the premises. They may also be taken by officers or employees of the Department of Food and Agriculture or by federal or county officers or employees when acting in their official capacities pursuant to the provisions of the Food and Agricultural Code pertaining to pests. Secondly, any owner or tenant of land or property that is being damaged or destroyed or is in danger of being damaged or destroyed by gray squirrels may apply to the California Department of Fish and Wildlife for a permit to kill such mammals. The Department, upon satisfactory evidence of such damage or destruction, actual or immediately threatened, shall issue a revocable permit for the taking and disposition of such mammals under regulations promulgated by the Fish and Game Commission. Mammals so taken shall not be sold, nor shipped from the premises on which they are taken, except under instructions from the Department. No poison of any type may be used to take any tree squirrel species. The Department shall designate the type of trap to be used to insure the most humane method is used to trap gray squirrels. The Department may require trapped squirrels to be released in parks or other nonagricultural areas.

Damage: Tree squirrels will strip the bark off of many tree species, and will readily consume a wide variety of nuts and fruits including green and ripe walnuts, almonds, pistachios, oranges, avocados, apples, strawberries, and tomatoes. Tree squirrels sometimes gnaw on lead covered telephone cables and they may gnaw into wooden buildings or invade attics through knotholes, etc. Tree squirrels can damage lawns by burying and digging up nuts. They are also common pests at bird feeders and have been known to damage bird houses in their search for eggs and nestlings. The Douglas squirrel's pine cone diet limits its potential for agricultural depredations. Squirrels may carry rabies, toxoplasmosis, sylvatic plague, western encephalitis, encephalomyocarditis, murine typhus fever, tularemia, endemic relapsing fever, and ringworm, all of which are transmissible to man.

Range: The western gray squirrel is a native species found from the Mexican border north through the Coastal Ranges to the Oregon border, and from the Tehachapi Mountains north along the western slope of the Sierra Nevada. The eastern fox squirrel is an introduced species established in city parks and adjacent areas in Fresno, San Diego, San Mateo, Santa Cruz, San Fernando, Sacramento, San Francisco, and the South Bay area and in agricultural land east of Ventura and Oxnard in Los Angeles County. The eastern gray squirrel has been introduced from populations in the eastern portions of the United States into Golden Gate Park in San Francisco and is established in a small portion of Calaveras and San Joaquin Counties. The Douglas squirrel is a native of the north coastal area and the Sierra Nevada Mountains.

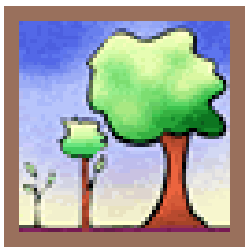
Eastern Fox Squirrel

Western Gray Squirrel

Eastern Gray Squirrel

Douglas Squirrel

Habitat: Western gray squirrels live in oak woodland areas in the foothills and valleys and in pine-oak forests in the mountains. The native habitat of the eastern fox squirrel is open hardwood forests in the northern states and pine forests of the south. Eastern gray squirrels live in hardwood forests with nut trees and in river bottoms in its native region. The Douglas squirrel inhabits coniferous forests of the upper pine belt and fir, spruce, and hemlock forests.



Biology: All four listed tree squirrels are diurnal. Tree squirrels are easily distinguished from ground squirrels and chipmunks by their long bushy tails, the lack of dorsal spots or stripes, and the absence of internal cheek pouches. Although they are chiefly arboreal, some tree squirrels spend considerable time foraging on the ground, particularly the eastern fox squirrel and the western gray squirrel. Tree squirrels are most active in early morning and late afternoon; they nest in tree cavities, enlarged woodpecker holes, or high in a tree in a spherical nest they construct of twigs, leaves, and shredded bark. Tree squirrels do not hibernate and are active year-round.

Food: The eastern fox squirrel's diet is primarily made up of various nuts, acorns, seeds, fungi, bulbs, and roots and cambium tissues, although bird eggs and insects are occasionally consumed as well; sometimes, nuts are buried.

The western gray squirrel is primarily an acorn eater, supplementing this diet with conifer seeds, nuts, mushrooms, tender twigs and shoots, and grain if it is available. They spend much time in autumn burying fallen acorns singly in holes three to four inches deep; mushrooms and nuts are also stored for winter use.

The eastern gray squirrel feeds on a variety of nuts, seeds, mushrooms, fruits, and the cambium layer beneath the bark of trees. Like their western cousin, they bury nuts and acorns in the ground, many of which are never recovered; some of these sprout into trees. Buried acorns are retrieved by the sense of smell.

The Douglas squirrel lives largely on conifer seeds, which are harvested in the cones in early autumn. Each squirrel usually cuts off a number of cones before coming to the ground and gathering them. Cones may be stored in large caches in moist places or in stumps. Douglas squirrels tunnel through the snow to reach their caches in winter.

Nesting and Territory: The eastern fox squirrel nests in tree cavities or builds a twig and leaf nest in a crotch or branch, usually 30 feet or more from the ground. The home range is 10 to 40 acres. Populations range from 1/2 to 3 squirrels per acre.

The western gray squirrel usually enlarges an old woodpecker or flicker hole for its brood den, or it may construct a nest of twigs and shredded bark far out on the branches of a large tree; the nest is usually 20 feet or more above the ground. The home range is 1/2 to 2 acres, and populations do not usually exceed 2 squirrels per acre. Females display territorial behavior when young are in the nest.

The eastern gray squirrel also nests in holes in trees, or constructs a nest of leaves on an outer tree branch. The nest is usually 25 feet or more from the ground. Their home range is 2 to 7 acres, and populations may range from 2 to 20 squirrels per acre.

The Douglas squirrel nests in a woodpecker hole or other small tree cavity, in a slope of rocks, or in a nest of leaves, twigs and shredded bark in a tree branch, usually near the tree trunk. The home range is less than 200 yards across. Populations of 2 squirrels per 3 acres are probably average, but it may be as high as 10 per acre. The Douglas squirrel displays territorial behavior by protecting its food supply.

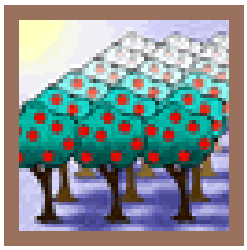
Breeding and Longevity: The young of the eastern fox squirrel are born between January and April and between July and September. Yearling females have 1 litter and older females have 2 litters per year. The gestation period is 44 days and the young are weaned at 2 to 3 months. The eastern fox squirrel may live 10 years or more in captivity; 6 years is the longevity record in the wild.

The western gray squirrel produces 1 litter of 3 to 5 young born between February and June. The gestation period is 44 days and the young remain in the nest at least 6 weeks before going out on their own. Western gray squirrels have lived 11 years in captivity. Primary predators include coyotes, foxes, owls, and large hawks, which usually catch the squirrel on the ground. Western gray squirrels are fairly safe in trees, except when they extend their range into higher mountain zones where the marten lives.

Deep snow limits the western gray squirrel's range because they have difficulty in retrieving buried acorns under the snow.

The eastern gray squirrel bears 2 litters of 3 to 5 young annually, in late winter and in late summer. The gestation period is 44 days, and the young are weaned at 2 months. Essentially no individuals survive past 7 years in the wild.

The Douglas squirrel apparently has 2 litters per year, with young born in June and October. The average litter size is 5 (range 4 to 8) and the gestation period is about 38 days. Maximum life expectancy is 5 to 6 years in the wild. Coyotes, foxes, bobcats, martens, goshawks, and owls are common predators.



Damage Prevention and Control Methods

Exclusion: Prevent squirrels from climbing isolated trees and power poles by encircling them with a 2-foot wide collar of metal 6 feet off the ground. Attach metal using encircling wires held together with springs to allow for tree growth. Trim trees appropriately to prevent squirrels from jumping onto roofs. This method has limited effectiveness because squirrels are such good climbers and they can jump 10 feet or more from one tree to another.

For squirrels that get inside of structures, it is essential that entry points be identified. Once identified, a heavy ¼-inch wire mesh or sheet metal should be installed as a cover. Squirrel excluders can also be constructed by installing an 18-inch plastic pipe over an opening at a 45° angle. A one-way door can also be used over a door to let squirrels out.

Squirrels can be prevented from traveling on wires with the installation of 2-foot sections of a lightweight 2 to 3 inch diameter plastic pipe. The pipe should be split lengthwise, spread open, and then placed over the wire. Never install these wire guards on or near electrical bearing lines. Only experienced professional electricians and power company employees should handle power lines.

Habitat Modification: Trees that overhang roofs or are close to telephone lines should be cut back at least 10 feet to slow the movement of squirrels around garden and home areas. However, squirrels can jump quite far so this distance may be insufficient in some situations. Trimming ivy can reduce squirrel accessibility to building rooftops. Bird feeders can be modified to deter squirrel foraging.

Frightening: A number of devices are available commercially; however, none have proven to be effective. Tree squirrels quickly become accustomed to both visual and sound devices intended to frighten. Any effect is usually very temporary.

Fumigants: None are registered.

Repellents: Ro-pel® is a taste repellent that can be applied to seeds, bulbs, flowers, trees, shrubs, poles, fences, siding and outdoor furniture. Efficacy of this repellent is questionable for tree squirrels, with little data available to verify its effectiveness.

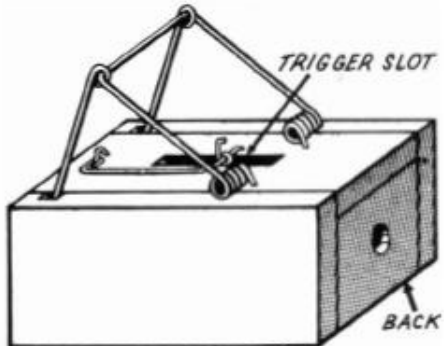
Polybutenes are sticky materials that can be applied to building surfaces to deter squirrels from chewing or climbing. It has limited effectiveness and can be both costly and messy.

Toxic Bait: None are registered.

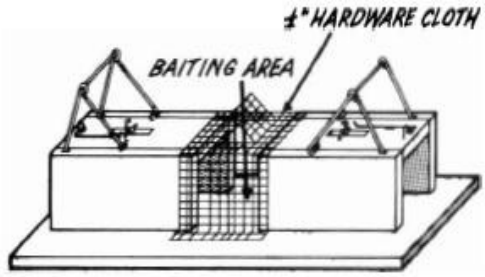
Trapping: One means of controlling eastern fox squirrels is through the use of tube or tunnel-style traps. These traps almost completely remove captured squirrels from public view. Tunnel traps can be used with or without bait. When attempting to capture eastern fox squirrels in or around structures, place the trap near squirrel entrance points into and out of the structure. Tunnel traps can also be placed along travel routes; baiting may increase efficacy of such traps. Keep in mind that

other species may be attracted to these traps; non-baited trap-sets reduce the potential for non-target capture.

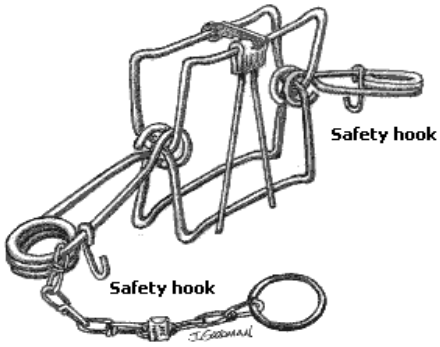
Another trap option is a modified wood box-type gopher trap. To construct this trap, remove the back of the gopher trap. Then lengthen the trigger slot with a rat tail file of pocket knife to permit unhindered trigger swing. This makes it possible for the animal to pass the swinging loop of the unset trap.



A single trap is constructed by the use of hardware cloth to extend and close the open end. This provides additional baiting area and allows the bait to be observed from both ends but prevents the animal from entering except from the front. The trap is secured to a board for placement in a tree.



Two modified traps may also be placed back to back and secured to a board (1" × 4" × 18"). A small strip of hardware cloth connects the two and forms a baiting area. Baiting is accomplished by placing a handful of bait through a small door cut in the wire or through the open end of the trap.



Body-gripping traps, such as the Conibear 110, are lethal, very effective, and show a low avoidance rate given that they are rather inconspicuous when set. These traps are most commonly used in sets where the trap is set over the only entry available. Body-gripping traps should be covered, as captured squirrels may be unpleasant to view.

Wire-mesh box or cage traps can also be placed on the ground to capture tree squirrels. These traps are live traps, so non-target animals can be released unharmed. This makes these traps more appropriate for use in areas where non-target captures (e.g., cats and dogs) are a concern. However, captured squirrels must be euthanized by the trapper upon capture as translocation of tree squirrels is illegal unless in possession of a permit issued by the California Department of Fish and Wildlife, unloads your problem on others, and can spread disease. It is this extra step that limits the utility of live-trapping for some growers. Methods considered humane by the American Veterinary Medical Association include gassing with carbon dioxide and shooting. Drowning is not an approved method of euthanasia and is illegal in California.

When it comes time to bait and set traps, a handful of nut meats placed well behind the trigger mechanism will often attract tree squirrels. Sprinkling a few nuts at the entrance of the trap may increase capture rates. For best results, baited traps can be left unset for several days until the squirrels become accustomed to pushing back the swinging trigger loop to reach the bait. After the squirrels have become familiar with the traps, rebait and set all the triggers. A considerable number of fox squirrels can be taken with relatively few traps if they are kept in continuous operation while damage is occurring. Trapping should be commenced as soon as the first damage is observed.

Other: Shooting, where legal, can be effective. A .22-caliber rifle, shotgun with No.6 shot, or a .177-, .22-, or .25-caliber pellet gun are good options. Check with state and local ordinances to determine the legality of shooting in your area. Be aware that lead ammunition is no longer allowed in California condor range, and will be completely banned starting 2019. Non-lead ammunition is typically more expensive and may not be available depending on the caliber of gun used. Additional information on this lead ban can be found at: http://www.dfg.ca.gov/wildlife/hunting/condor/.

REFERENCES AND ADDITIONAL READING

Jackson, J.J. 1994. Tree squirrels. Pages B171–B175 *in* S.E. Hygnstrom, R.M. Timm, and G.E. Larson, editors. Prevention and Control of Wildlife Damage. University of Nebraska Cooperative Extension, U.S. Dept. of Agriculture, and Great Plains Agricultural Council, Washington D.C.

Koehler, A.E., R.E. Marsh, and T.P. Salmon. 1990. Frightening methods and devices/stimuli to prevent mammal damage—a review. Proceedings of the Vertebrate Pest Conference 14:168–173.

Marsh, R.E., A.E. Koehler, and T.P. Salmon. 1990. Exclusionary methods and materials to protect plants from pest mammals—a review. Proceedings of the Vertebrate Pest Conference 14:174–180.

Sullivan, T.P. 1998. Management of red squirrel feeding damage to lodgepole pine by stand density manipulation and diversionary food. Proceedings of the Vertebrate Pest Conference 18:196–202.

———

*Chapter last updated: 28 October, 2015***

Suggested citation:

Baldwin, R.A., and R. Meinerz. 2015. Tree squirrels. Pages 284–290 *in* Vertebrate Pest Control Handbook, R.A. Baldwin, editor. Sixth edition. California Department of Food and Agriculture, Sacramento, CA. http://www.vpcrac.org/files/6614/2844/5061/Treesquirrel.pdf

**Adapted from several previous additions authored by D.O. Clark, J.P. Clark, and T.P. Salmon, among others.